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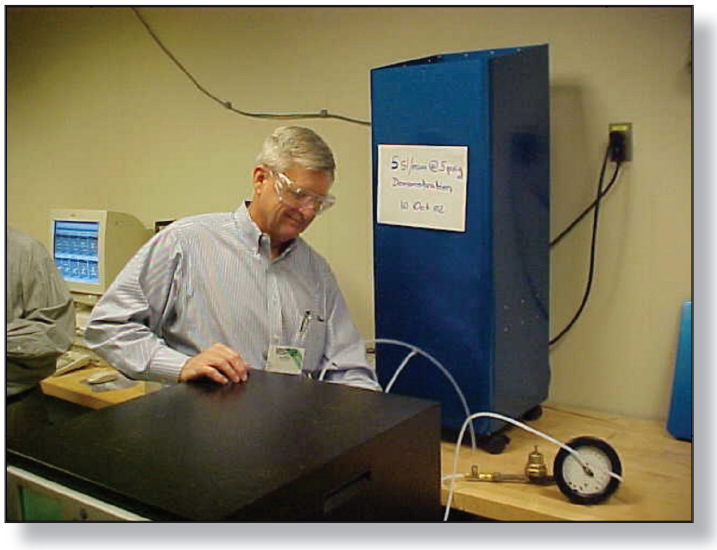
Science and Technology for Tomorrow's Air and Space Force

Success Story

SOLID ELECTROLYTE OXYGEN SEPARATOR BREADBOARD SUCCESSFULLY DEMONSTRATED



A newly developed Solid Electrolyte Oxygen Separator (SEOS) breadboard device uses a heated ceramic membrane to separate oxygen from ambient air to produce an oxygen flow with a purity of >99.9%. SEOS technology does not require an air compressor, can produce purities of >99.9%, can guarantee protection from chemical and biological agents, and has only one moving part to improve reliability.

Researchers believe this revolutionary technology will eventually replace molecular sieve-based technology. This Human Effectiveness Directorate 6.2 Science and Technology program milestone represents significant progress towards an oxygen generation at point-of-use capability for the Department of Defense aircrew and passenger breathing systems. SEOS systems have a wide range of potential applications such as aeromedical evacuation, battlefield oxygen, deployed medical facilities, trickle charging of aircraft oxygen systems, and aircraft oxygen generating systems.

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Accomplishment

Air Products and Chemicals, Inc. of Allentown, Pennsylvania, teamed with Ceramatec, Inc. of Salt Lake City, Utah, to demonstrate an SEOS breadboard device that represents the highest verified flow rate achieved to-date for a ceramic-based oxygen generator. The breadboard produced >99.9% purity oxygen at a flow rate of 5 liters/minute and pressure of 5 pounds/square inch, meeting all objectives of the directorate's 6.2 Science and Technology Congressional Add program to advance SEOS oxygen generation technology for military ground-based and airborne applications. Air Products and Chemicals, Inc. demonstrated the SEOS breadboard device at their Allentown facility to representatives from the US Army, US Navy, and US Air Force.

SEOS uses a heated ceramic electrolyte material and direct current voltage. Ambient air passes over the electrolyte where oxygen molecules are ionized, and negatively charged oxygen ions pass through the crystalline structure of the electrolyte. Upon reaching the opposite side of the electrolyte, the oxygen ions recombine to form molecular oxygen.

Background

Aircrews must breathe oxygen to prevent hypoxia. Currently, aircrews receive oxygen from one of three systems: liquid, high-pressure gaseous oxygen, and on-board oxygen generating systems (OBOGS). Both liquid and high-pressure gaseous oxygen systems require pre-flight filling. However, the military desires to eliminate the costly and bulky infrastructures associated with these systems.

At this time, some aircraft have OBOGS that use molecular sieve technology to separate oxygen from engine bleed air. However, molecular sieve technology has some limitations: ground-based systems (such as, aeromedical systems) require a separate air compressor, airborne systems require significant amounts of engine bleed air, oxygen purity is limited to 93%, and molecular sieve-based systems cannot guarantee chemical and biological protection.

Human Effectiveness
Emerging Technologies

Additional information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (03-HE-28)